PROPHYLACTICS

IN CHARGE OF
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THE RELATION OF BACTERIOLOGY TO PREVENTIVE MEDICINE

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(Continued)

THE bacillus coli communis discovered in 1885 is specially of interest from its morphological resemblance to the bacillus of typhoid fever, but differs from it in its manner of growing in different culture media. This organism is a normal habitant of the intestines of healthy individuals, but when it finds its way into the peritoneal cavity may cause peritonitis. How much influence this organism has in causing appendicitis has not been definitely proved, but it is reasonable to suppose that its presence in the appendix may be a predisposing, if not the exciting, cause of the disease. At the Bacteriological Laboratory of the Harvard Medical School two years ago cultures were made from the interior of the appendix in fifteen cases of appendicitis. It was observed that when the bacillus coli communis was found in the cultures the patients were extremely ill and in many instances died, while in those cases in which this organism was not found the patients went on to an uninterrupted recovery. The number of cases is too small on which to base any conclusions, but it opens a field for a very interesting and important research.

No discovery in bacteriology has been more important or has had a greater influence on the suppression of epidemics than that of Koch's of the spirillum of Asiatic cholera in 1884. The importance of an early diagnosis of mild cases of the disease and an accurate knowledge of the degree of infectiousness of cholera have been fully demonstrated by the history of the late epidemic. The history of the earlier epidemics of cholera in this country show conclusively the impossibility of making an accurate diagnosis in the milder cases of the disease without a bacteriological investigation, and it is from these mild cases that the epidemics have universally arisen. If the few cases that occurred in New

York City had not been recognized by means of a bacteriological examination, there is no question but that we should have had a wide-spread and general epidemic of the disease. This organism is a spirillum, and resembles in appearance a small comma, hence its name, comma bacillus, although the term bacillus is a misnomer, as it is not a rod but is a spirillum, the individual segments of which are curved. On a well-stained cover-glass from a luxuriant growth long, screw-shaped forms may be seen, sometimes extending along the entire field of the microscope. This organism stains with the usual aniline colors. The spirillum of Asiatic cholera cannot be differentiated by the microscope alone from certain other organisms. The Finkler-Prior spirillum found in cholera morbus, the Deneke cheese spirillum found in old cheese, the spirillum of Metschnikoff found in the intestinal contents of chickens dying of an infectious disease which prevails in certain parts of Russia, resemble the organism of cholera in morphology, but there are certain cultural peculiarities of the organism which render its differentiation certain. The action of this organism in pure cultures in gelatin is so different from that of the other organisms mentioned that there can be no question that it is an entirely separate and distinct species, and has nothing in common with the others except its shape when seen under the microscope. That this organism is the specific cause of cholera has been absolutely proved in many ways. Its presence in drinking-water during an outbreak of cholera, the fact that it has been found in the alvine discharges of cholera patients, in the intestines of cholera cadavers, and the experiments on animals would seem to place this fact beyond a reasonable doubt. Koch's experiments on guinea-pigs are very satisfactory, and show that this spirillum is pathogenic for these animals when introduced in a living condition into the intestines. As this organism is particularly susceptible to the action of acids, particularly that of the gastric juice, it is necessary when experimenting on animals with it to neutralize the gastric juice with a solution of sodium carbonate, and it is also necessary, for the purpose of restraining the peristalsis of the intestines, to narcotize the animal with laudanum. After the administration of the opium a pure culture of the cholera spirillum is injected into the stomach. As the result of this procedure the animal becomes ill, its hind legs become weak and apparently paralyzed, and death usually occurs at the end of forty-eight hours. At the autopsy the small intestines will be found filled with a watery fluid containing spirilla in immense numbers. As a control experiment other animals are subjected to similar procedures, with the exception that pure cultures of the spirillum are not injected. The latter animals always recovered. It is said that Pettenkofer drank a considerable quantity of a pure culture

of this organism, and it is also true that he was very ill and came very near dying with what very much resembled an attack of cholera, and it is also true that immense numbers of the spirilla were found in the dejections. It would seem that these experiments should satisfy any sane person of the fact that the spirillum discovered by Koch is the specific cause of cholera.

Pneumonia, a disease which is especially frequent in this locality, has been definitely proved to be due to a certain specific organism. The pneumococcus of Friedländer, discovered by him in 1883, was thought at one time to be the cause of the disease, but more extended and careful examinations showed that this organism was not the cause of the disease, as it was only found in a small proportion of cases examined—nine times in one hundred and twenty-nine cases examined by Weichselbaum, three times in seventy cases examined by Wolff. This organism is an extremely short bacillus with rounded ends, often so short as to resemble a micrococcus, and is commonly united in pairs and chains of fours. As it only occurs occasionally in pneumonia, as has been before stated, it is only of interest from a scientific point of view, and allusion has been made to it simply to illustrate the importance of the most careful and searching investigation in everything connected with bacteriology before any definite conclusions can be reached. The micrococcus pneumoniæ crouposæ, which is also known by the name of micrococcus of sputum septicæmia of Fraenkel, has been fully identified as the cause of pneumonia. This organism is found in the rusty sputa of cases of pneumonia and also in the hepatized tissue of the diseased lungs. This bacterium cannot be regarded as a coccus, but should more properly be termed a bacillus, as one diameter is longer than the other. When seen under the microscope it has a peculiar lancet-like appearance, hence one of its synonyms is the lancet-shaped micrococcus. Guinea-pigs, rabbits, and mice inoculated with pure cultures usually die in from twenty-four to forty-eight hours. Soon after the inoculation in the skin of the abdomen the first symptoms of disease are noticed. At the autopsy very slight if any reaction at the inoculation-point is noticed. There is marked swelling of the spleen, which is frequently increased to twice its ordinary size. Large numbers of the bacilli are found in this organ. The lungs in particular show no marked evidences of infection. When, however, this organism is injected directly into the lung tissue it gives rise to violent inflammation of the organ. This bacterium is found very frequently in the saliva of healthy individuals, but just when and under what circumstances it may give rise to pneumonia has not been satisfactorily explained. Sternberg found that when the saliva from healthy individuals was injected into the peritoneal cavity of guinea-pigs it

almost invariably caused their death. The whole matter regarding this organism may be summed up in the following quotation from Fraenkel's text-book of bacteriology: "Fraenkel's bacterium is the principal exciter of inflammable processes of an infectious nature in the human body. Wherever it reaches a serous or mucous membrane and meets with the requirements for its settlement, it commences operations; it causes meningitis on the pia mater, peritonitis on the peritoneum, and otitis in the auditory passage. Whenever it gains entrance into the lungs, pneumonia is developed, the peculiar properties and characteristic process of which depend upon the peculiarities of the organ invaded and upon the extent of the morbid process. Another bacterium may eventually play a similar rôle and give rise to pneumonia; but, as a rule, it is certainly Fraenkel's diplococcus that displays here its energy, for which reason it may properly be regarded as the real micro-organism of genuine croupous lung-inflammation."

The disease known as hog cholera is sufficiently frequent among swine to deserve a passing notice. Two or three epidemics have occurred in this locality during the past few years in which large herds were destroyed. It may assume an acute form in which death may occur in twenty-four hours, and a chronic form in which the disease lasts from two to four weeks. In the acute form hemorrhagic extravasations are found upon the mucous and serous membranes and in the parenchyma of the lungs, kidneys, and lymphatic glands. The spleen is generally very much enlarged and soft and dark in color. The most notable changes are found in the alimentary canal in the chronic form of the disease. Large spherical necrotic masses and extensive patches of membrane are found in the cæcum and colon. The specific organism of this disease is found in all of the organs, especially the spleen, and has also been found in urine taken from the bladder immediately after the death of the animal. This bacterium, which was first described by Klein in 1884, is a short bacillus with rounded ends. Smith has proved by his experiments that when dry it would live from nine days to several months. This has an important bearing upon the necessity of thoroughly cleansing and disinfecting the styes in which an epidemic of this disease has broken out. Novy has isolated from this bacillus a substance which he calls sustoxin. This is a yellowish-brown, syrup-like liquid which, injected into rats in doses of .12 to .25 of a cubic centimetre, causes their death in from twenty-four to forty-eight hours. Thus far no antitoxin for this disease has been discovered.

Tetanus, which, fortunately, is very rare, has been proved to be due to a specific bacillus. In 1884 Nicolaier caused tetanus by introducing garden earth beneath the skin of mice and rabbits, and transmitted the

disease to other animals by inoculations with pus or cultures in blood-serum containing the tetanus bacillus. Carle proved in 1884 that tetanus was an infectious disease which might be transmitted by inoculation from man to the lower animals. Sternberg caused tetanus in a rabbit by injecting beneath its skin a little of the mud from the street gutters of New Orleans. This organism seems to be widely distributed in the superficial layers of soil in temperate and more especially tropical regions. The deadly toy pistol of a few years ago caused many cases of tetanus, but the fact that the pistol was not at fault so much as the dirt on the victim's hands containing the tetanus bacillus was not fully appreciated. A punctured wound of the foot made with a rusty nail frequently causes tetanus, but it is not the rust of the nail which gives rise to the disease, but it is this organism, which is found under the rust, which is the cause. It is a slender, straight bacillus with rounded ends. Sometimes spherical spore-like bodies develop at one end of the rods, giving these a drum-stick or pin-shaped appearance. It is an anaërobic liquefying motile organism. Brieger obtained from pure cultures of this bacillus a toxine which he called tetanin, and which was found to kill in minute doses small animals. The animals all died with the characteristic symptoms of tetanus. The horse can be rendered immune by the injection of minute doses of this toxine, and the serum of the animal thus rendered immune has been used with beneficial results in the treatment of tetanus in man. While experimenting with the toxine of tetanus Behring's attention was directed to the immunizing of animals against diphtheria. One great difficulty in the anti-toxic treatment of tetanus is the fact that we have no indication that tetanus will result from a wound in man until definite symptoms have appeared: by that time the tetanus poison has accumulated to such an amount in the system that it is not always possible to antagonize it with sufficient doses of the antitoxin.

(To be continued.)

In the archaic-vase room at the British Museum anyone can gaze upon babies' feeding-bottles of sun-baked clay which were antique when Joseph went into Egypt.—*Boston Daily Globe, Friday, November 2.*